DATA MODUL

easy TOUCH

Data **M**odul **e**asy**M**ax**T**ouch

Driverless Controller User Guide

Rev 2.0

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1. Introduction

Data Moduls new generation of easyMaxTouch USB controllers includes a new firmware that is based on a standard HID pointer device for both single-and multi-touch. Since those HID device classes are an USB.org[1] standard there is no need for any kind of external drivers for most operating systems[2].

If the operating system includes HID multi-touch support, this is also possible without using any additional external driver.

Data Moduls easyMaxTouch “driverless” controller offers a very simple way to change the controller settings like adjusting touch sensitivity. By providing a configuration file which is saved on a mass storage drive on the easyMaxTouch USB controller, the adjustments are possible without any need of an additional tool or software.

Providing different operational modes, which are configurable via the configuration file, it is possible to easily switch between single- or multi-touch or even to hide the mass storage drive so that the configuration cannot be changed anymore.

[1] http://www.usb.org/developers

[2] Some operating systems may need a patch for internal configuration that is provided by Data Modul

2. Operational Modes

The Driverless firmware has different operational modes. Each mode is defined by its available features.

The following features are possible:

Feature	Description
MS (Mass Storage)	Allows the user to change the configuration of the touch controller using a text file (see chapter Configuration using Mass Storage Device).
ST (Single Touch HID)	In this mode the touch controller behaves like a mouse with absolute coordinates. That means that only one touch is reported from the USB controller. Use this mode for operating systems with no multi touch support. To use the right mouse click please touch the sensor for at least 1.5 seconds on the same position. **Caution**: Right-click functionality and performance may differ between operating systems.
MT (Multiple Touch HID / Digitizer)	In this mode up to 10 touches can be reported from the USB controller to the operating system. **Caution:** Use this mode only if your operating system supports the USB HID multi-touch class (see chapter operating system).
CH (Config HID)	In this mode it is possible to use the easyANALYZER software for debugging and configuration.

These are the available operational modes and their active features:

Mode	Features	Description
0		This mode shall not be used! For recovery the MS is active in all invalid modes.
1	MS + ST	Mass Storage and Single Touch
2	MS + MT	Mass Storage and Multi Touch
7	ST + CH	Single Touch and Config HID
8	MT + CH	Multi Touch and Config HID

To change the mode see chapter Examples “change operational mode”.

3. Configuration using Mass Storage Device

The Driverless firmware allows the user to change the configuration of the easyMaxTouch USB controller using a text file.

If the Mass Storage Interface is enabled the easyMaxTouch USB controller will be detected as a composite USB device that also has a mass storage interface enabled. This mass storage interface is used like an USB stick. Therefore the operating system will treat this interface the same way. The easyMaxTouch mass storage drive has a size of 35kB and is based on a FAT file system. It contains only one file named “maxtouch.txt”.

Configuration settings can be changed by writing data into the text file. The currently active configuration can be read by opening the file.

Please note that while working with the configuration file on the mass storage drive there is **absolutely no connection** between the data that is written into the file and the data that can be read from the file because the operating system may try to buffer the data! After buffering the data the operating system overwrites the data written to the file as current content.

If the maxtouch.txt file does not show the settings that where just entered, it may be necessary to reset the controller using the reset command or restart your OS. Please consult the examples section for the needed commands.

The easiest way to edit the maxtouch.txt is to use a text editor that directly edits the file and does not create a local copy of the file and then tries to overwrite the maxtouch.txt.

Regarding writing and reading from Mass Storage Device there are some OS dependencies that must be considered:

Windows CE5/CE6/EC7

How to change a parameter on the maxtouch.txt

- Reset your embedded computer
- Do **not** open the file maxtouch.txt **directly** from the Mass Storage Device
- Copy the file maxtouch.txt from the Mass Storage Device to a local directory
- Modify and save the file **locally** (not in Mass Storage Device)
- Copy the file maxtouch.txt from the local directory back to the Mass Storage Device
- Do **not** open the file maxtouch.txt directly on the Mass Storage Device
- Reset your embedded computer for the settings to be applied

How to read the content of maxtouch.txt

- Reset your embedded computer
- Do not open the file maxtouch.txt directly from the Mass Storage Device
- Copy the file maxtouch.txt from the Mass Storage Device into a local directory
- Open your local copy of maxtouch.txt

3.1 Write User Settings

In order to write a new configuration to the controller, commands must be written into the maxtouch.txt file. Each line of the text file contains one command which ends with a RETURN. At the end of the file there must be at least one empty line. A command is usually followed by a value.

The value can be any number between 0 and 255.

<command> = <Value>

Example: “Sensitivity threshold = 20”

The following commands are supported:

Command	Description	Range	Typical Value
Sensitivity threshold	Sets the touch sensitivity threshold.	0-255	20-45
Switch X and Y	Switches X and Y orientation.	0,1	0
Invert X coordinates	Inverts X coordinates.	0,1	0
Invert Y coordinates	Inverts Y coordinates.	0,1	0
Initial movement hysteresis	This setting is used to detect an initial movement. Setting this parameter with a high value will make the system less sensitive to non-desired small finger movements (avoiding cursor flickering). At the same time a larger finger movement will be necessary for starting the cursor to move.	0-255	2-5
Next movement hysteresis	This setting is used to detect further movement (after initial movement). Setting this parameter with a low value will increase the sensibility of the cursor in a movement.	0-255	2

Command	Description	Range	Typical Value
Touch detection integration	This setting is used to provide detection filtering. A counter is incremented each time a touch is detected. If the counter reaches the given limit, it will be reported as touch-event to the operating system. This is very useful to supress electrical noise.	0(1), 1-255 (0 and 1 means no integration)	3
Number of reported touches	Defines the number of touches reported by the touch controller. Range: 1-10. In order to keep response time short, use the lowest possible value suitable for your application. In Single Touch Mode (operational mode = 1) there is only one touch reported to the operating system.	1-10	10
Touch automatic calibration	Defines the duration a touch is held until it is considered as false and an automatic calibration is performed to compensate. This is useful to keep touchscreen operating when foreign objects (dirt, water drops) are located on the touch surface. After an automatic calibration the field-change at the position of the object is considered as normal, so no unexpected touch-events are generated anymore.	0 (infinite), 1-255 (in 200ms increments)	50
Clipping X low	This setting can be used to adjust the touch area (see	0-127 or	0

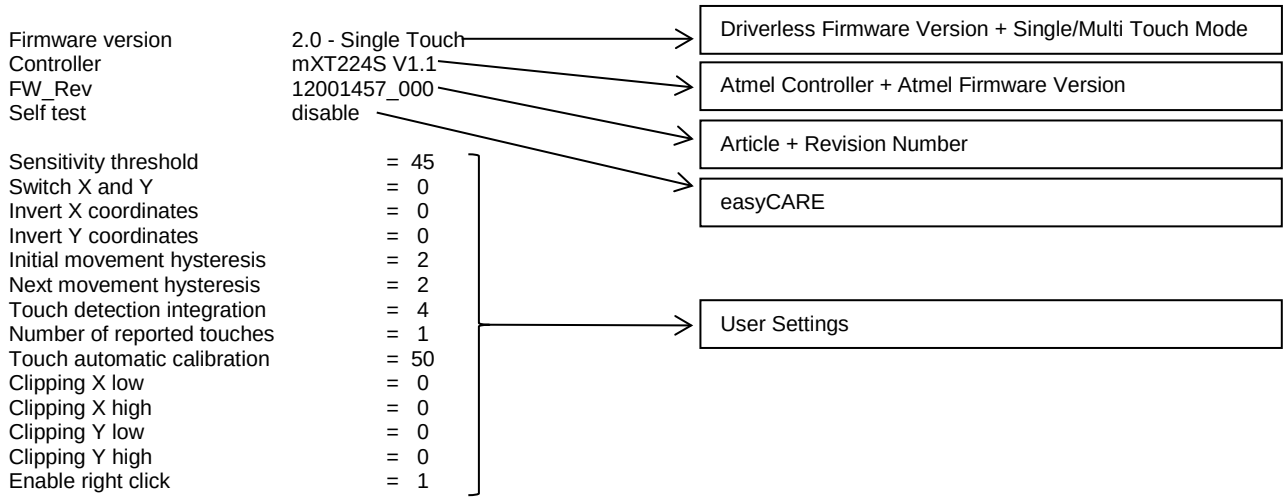
Command	Description	Range	Typical Value
	appendix 1).	-1 to -128	
Clipping X high	This setting can be used to adjust the touch area (see appendix 1).	0-127 or -1 to -128	0
Clipping Y low	This setting can be used to adjust the touch area (see appendix 1).	0-127 or -1 to -128	0
Clipping Y high	This setting can be used to adjust the touch area (see appendix 1).	0-127 or -1 to -128	0
Enable right click	This setting can be used to enable right click (for Single Touch only).	0-1	1

The following commands will not be visible in the modified maxtouch.txt after a reset:

Command	Description	Range	Typical Value
reset	Resets the controller.	no value	no value
operational mode	Sets the operational Mode to the supplied value (see chapter operational modes).	1,2,7,8	1
debug	Displays easySETTINGS in maxtouch.txt.	no value	no value
store	Writes all easySETTINGS to the controller. Requires a reset afterwards.	no value	no value

3.2 Read User Settings

Example for the maxtouch.txt file:


Firmware version 2.0 - Single Touch
Controller mXT224S V1.1
FW_Rev 12001457_000
Self test disable
Sensitivity threshold = 45
Switch X and Y = 0
Invert X coordinates = 0
Invert Y coordinates = 0
Initial movement hysteresis = 2
Next movement hysteresis = 2
Touch detection integration = 4
Number of reported touches = 1
Touch automatic calibration = 50
Clipping X low = 0
Clipping X high = 0
Clipping Y low = 0
Clipping Y high = 0
Enable right click = 1
Driverless Firmware Version + Single/Multi Touch Mode
Atmel Controller + Atmel Firmware Version
Article + Revision Number
easyCARE
User Settings

4. Operating Systems

With the technology of the Driverless firmware, easyMaxTouch USB controllers can be used with the most common operating systems. The following table gives an overview of the tested operating systems and the available features.

Operating System	**Version**	**Operational Mode**	**Note**
Win XP	Professional SP3	ST	
Win7	Professional 32 bit / 64 bit	ST	
		MT	
Linux	Ubuntu 12.04 LTS (Precise Pangolin) 3.5.0-23-generic 32 bit	ST	Limited right click functionality may depend on used window manager and X configuration.
		MT	For multi touch under Linux please refer to the Application Note “Multitouch under Linux”[3].
WinCE 5		ST	The document: touchHID_WinCE_Patch_Instalation.pdf shows you how to install the Windows CE patch for Data Modul easyMaxTouch using Driverless HID.
WinCE 6		ST	
WEC 7		ST	
		MT	

[3]http://www.data-modul.com/tl_files/images/Downloads/Application%20Note%20-%20multi-touch%20under%20Linux.pdf

5. Examples[4]

5.1 Change sensitivity threshold

1. Open mass storage device named “Max Touch”.
2. Open the text file maxtouch.txt.
3. Edit the text file with an editor that creates no local copy of the file.
4. Now you can change the sensitivity threshold value:

   In some cases it is necessary to reset the controller to apply the new settings. For this the reset command can be used.

   Attention: It is important to press “Enter” after a new command

   ```
   “Firmware version          2.0 - Single Touch
   Controller                 mXT224S V1.1
   FW_Rev                     12001457_000
   Self test                  disable

   Sensitivity threshold   = 30
   Switch X and Y          =  0
   ….”
   reset\r\n    //reset the controller
   ```

5. Save maxtouch.txt.

5.2 Change operational mode

1. Open the text file maxtouch.txt

   Attention: It is important to press “Enter” after a new command

   ```
   “Firmware version          2.0 - Single Touch
   Controller                 mXT224S V1.1
   FW_Rev                     12001457_000
   Self test                  disable

   Sensitivity threshold   = 30
   ….”
   operational mode = 1\r\n    // Single Touch HID
   reset\r\n    //reset the controller
   ```

2. Save maxtouch.txt.

[4] Please note that this examples are tested under Windows XP only

6. easySETTINGS support

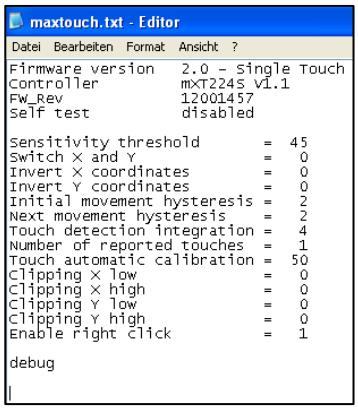
6.1 Introduction

The driverless firmware version 2.0 or higher supports encrypted controller configurations (easySETTINGS). With this feature it is possible to display the easySETTINGS in the maxtouch.txt file or to write a configuration to the touch controller. The easySETTINGS include all controller parameters, which can be used to send it to Data Modul for support requests.

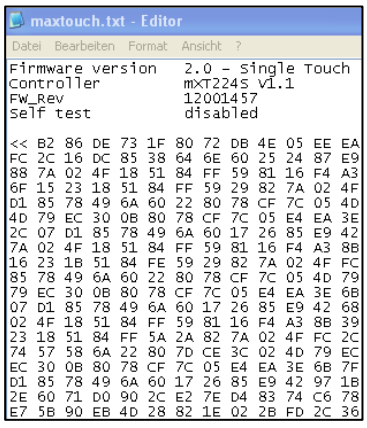
6.2 Display easySETTINGS

Displaying encrypted customer data is very easy:

1. Plug in the easyTouch controller to the PC.


maxtouch.txt - Editor
Datei Bearbeiten Format Ansicht ?
Firmware version 2.0 - Single Touch
Controller mXT224S v1.1
FW_Rev 12001457
Self test disabled
Sensitivity threshold = 45
Switch X and Y = 0
Invert X coordinates = 0
Invert Y coordinates = 0
Initial movement hysteresis = 2
Next movement hysteresis = 2
Touch detection integration = 4
Number of reported touches = 1
Touch automatic calibration = 50
Clipping X low = 0
Clipping X high = 0
Clipping Y low = 0
Clipping Y high = 0
Enable right click = 1
debug

2. Open the maxtouch.txt file from the mass storage device.
3. At the end of the file type: debug[return].
4. Save the file (CTRL+S or File/Save).
5. The controller is now rebooting.



6. After rebooting, the maxtouch.txt should look like this:
7. Save the file to a local directory.

6.3 Save easySETTINGS to touch controller

1. Delete maxtouch.txt from the mass storage device.
2. Open the easySETTINGS file.

```
51 84 FF 59 29 82 7A 02 4F FC 2C 07 D1 85 78 49
6A 60 22 80 78 CF 7C 05 4D 79 EC 30 4D 79 EC 30
0B 80 78 CF 83 37 E5 E8 73 0A 07 DC 78 68 A4 E6
10 69 4A 9F E8 D9 7A 16 BD 97 29 82 7A 02 4E 18
35 84 9B 58 81 27 C6 90 BF 0C B1 31 2E 1A 38 51
84 FE 49 38 80 7E 00 4C EE 3F 03 D4 81 7D 5D 7F
62 24 86 7F D9 68 07 4A 71 E5 28 54 7B E4 3A 00
9A 63 CD 75 09 E9 F6 23 69 75 F2 23 19 CE 87 73
B6 95 9F E8 D9 7A 16 BD 97 D6 7D 85 FD B0 E7 >>

store
reset
```

3. At the end of the file type: store[return] and reset[return].
4. Copy the easySETTINGS file into the mass storage device.
5. The controller is now rebooting.
6. After reboot, all controller parameters are updated.

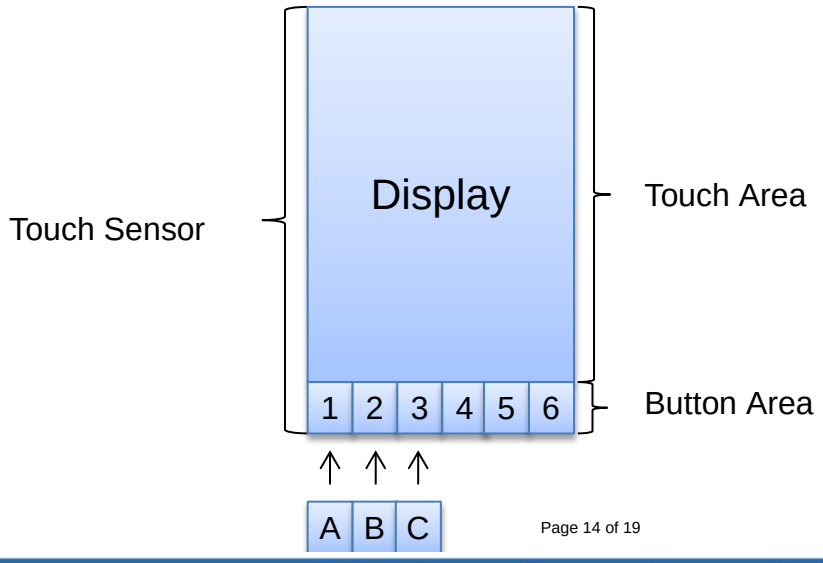
7. easyBUTTON support

The driverless firmware supports eight touch keys which can be defined along the edges of the touch sensor in special button area. Additionally a touch area can be defined for single or multi touch. easyBUTTON support can be used with easyMaxTOUCH I and easyMaxTOUCH III controllers which feature the Atmel mxt224S and mxt1664S controllers. To use easyBUTTON support, the firmware can be switched in two special operational modes. These two modes disable the mass storage device, enable ST or MT mode and a keyboard HID device. This device reports the pressed key to the host device like a common USB keyboard. Additionally there will be a special USB protocol provided by the Config HID device which allows the configuration of the keys. These enhancements are available from driverless firmware versions 2.0 and higher:

Main features:

- Unique solution for a PCAP sensor and PCAP buttons with only 1 controller
- Only 1 interface (USB) for buttons and sensor
- Up to 8 buttons configurable

For more information please contact your Data Modul AG contact person.

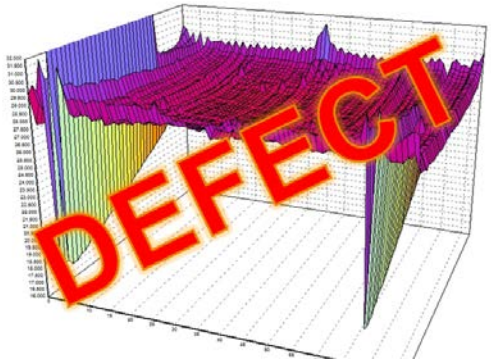


8. easyCARE

The easyCARE function checks if the sensor is damaged and if the sensor drive voltage is OK during startup of the controller.

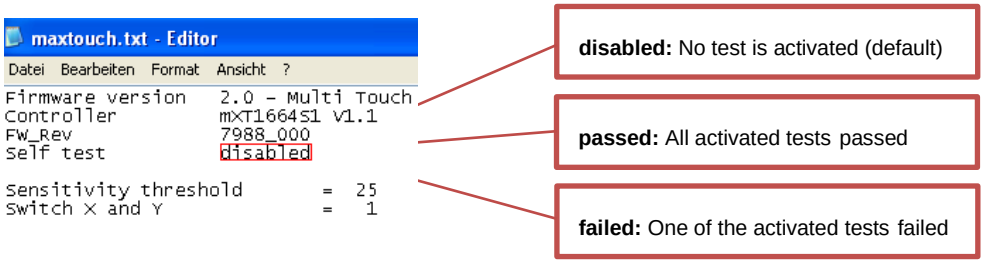
There are three tests which can be activated:

1. **Signal Limit Test**
   This test checks if the sensor reference values are in a given limit.



2. **AVDD Test**
   This test checks if AVdd or XVdd power is present.
3. **Pin Fault Test**
   This test can detect resistive line-to-line and low-resistance sensor shorts.

In maxtouch.txt file three states are printed:


maxtouch.txt - Editor
Datei Bearbeiten Format Ansicht ?
Firmware version 2.0 - Multi Touch
Controller mXT1664S1 v1.1
FW_Rev 7988_000
Self test disabled
Sensitivity threshold = 25
Switch X and Y = 1
disabled: No test is activated (default)
passed: All activated tests passed
failed: One of the activated tests failed

If one of the tests failed, there are two operational modes selectable:

1. Complete touch system hold, no touches will be reported.
2. A warning is printed in maxtouch.txt + normal operation (if possible with defect sensor).

Only available after consulting DATA MODUL.

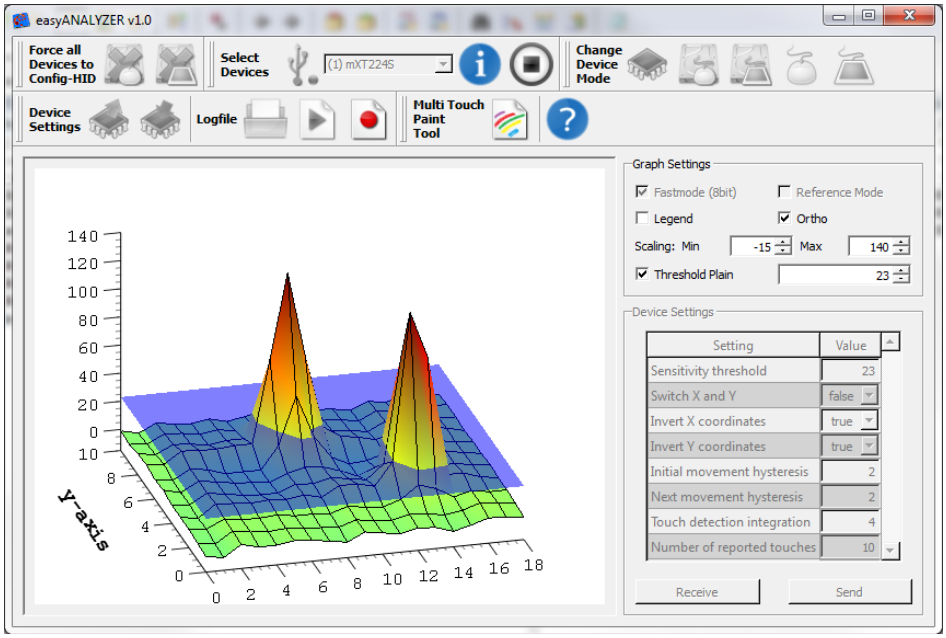
9. easyANALYZER support

The easyANALYSER application consists of a debugging, analysis and configuration toolset for fault detection. It is supported by Driverless firmware from version 2.0 on or higher with easyTouch S-Series controller.

The application communicates with the firmware via USB and visualizes the diagnostic data for a simple interpretation.

Main features:

- Displays reference values for sensor health check
- Displays raw touch signals to check for noise and SNR
- Record and playback the raw touch signals
- Recorded data file can be emailed to DATA MODUL for analysis
- Read and write basic controller settings (like in maxtouch.txt)
- Read and write encrypted easySETTINGS (complete controller settings)
- Change controller modes (single touch, multi touch)
- Enable / disable maxtouch drive (mass storage drive)
- Multitouch FULL SCREEN drawing tool (for multi touch only)



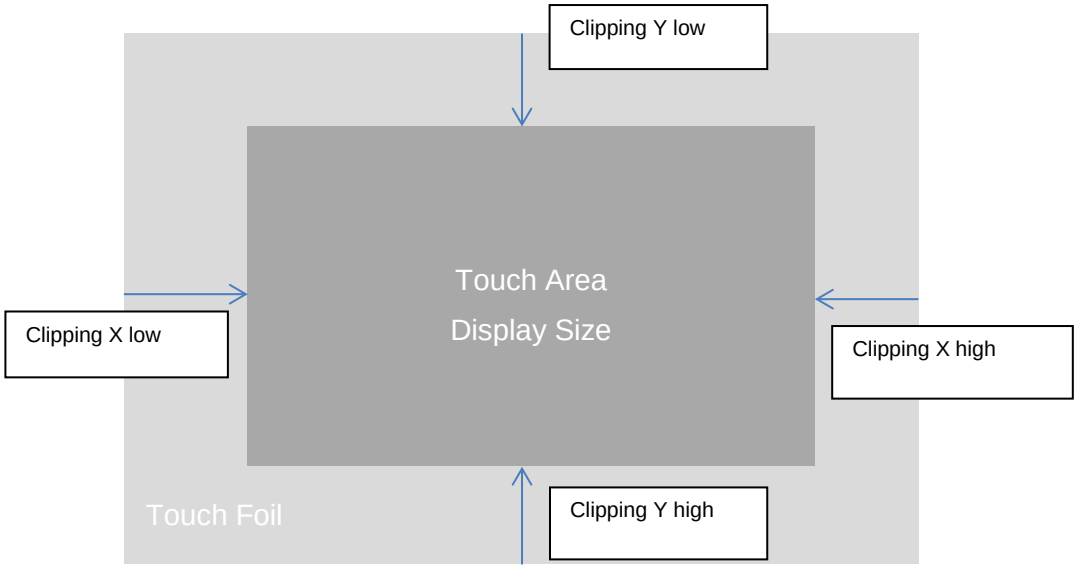
For more information please contact your Data Modul AG contact person.

Appendix 1:

Adjust the touch area to a smaller display:

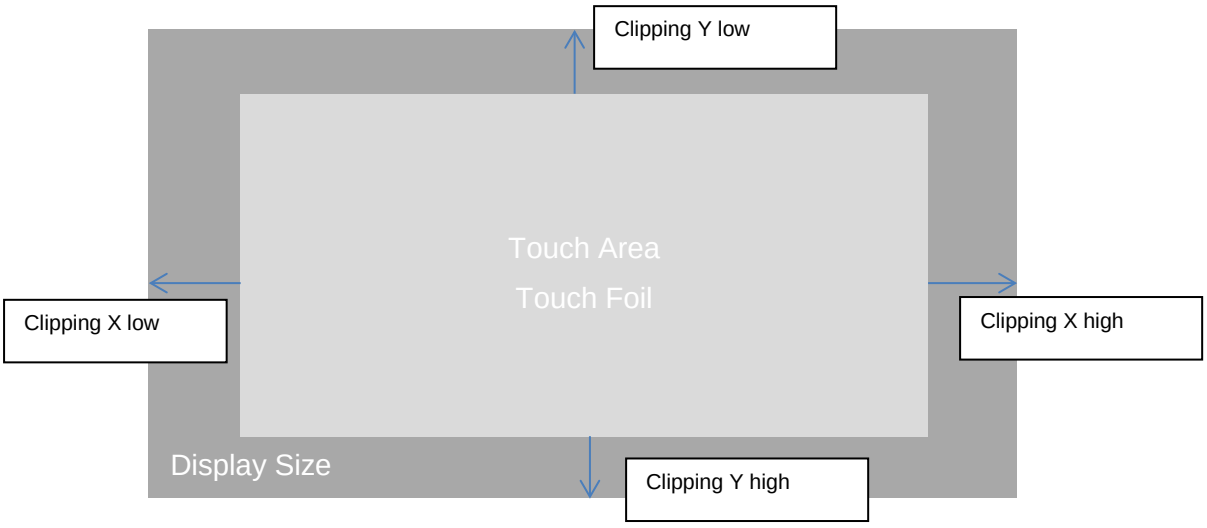
The settings (Clipping X low Clipping X high, Clipping Y low, Clipping Y high) in maxtouch.txt can be used to set up a clipping boundary. These fields allow settings in the range from -128 to 127. The maximum clipping value allows a clipping boundary one eight of the touch screen height or width. Positive values (0 to 127) increase the size of the clipping boundary. Below you can find an example to adjust a bigger touch area to a smaller display:

Example: Positive Clipping Boundary



Negative values (-1 to -128) are used for negative clipping boundary. For example to adjust a smaller touch area to a bigger display:

Example: Negative Clipping Boundary



Appendix 2:

Changes from Firmware 1.3 to 2.0

- Added easyBUTTON support
- Added easyANALYSER support
- Added easySETTINGS support
- Added easyCARE support
- Fixed multi touch right click issue

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